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Indiana Native Plant Society

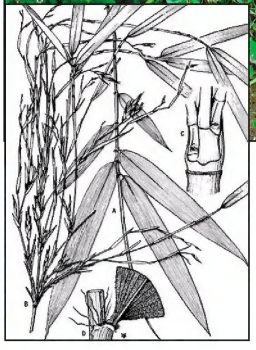
Summer 2024

A Lost Grassland – Cane and the Demise of Canebrakes in Indiana

By Michael Homoya

"The river valleys everywhere, beginning with the Ohio, and on southward, were covered with luxurious growth of cane, the "brakes" extending for miles in every direction… The fertility of the land on which they grew destroyed them quickly … because the first white settlers were quick to realize that a flourishing canebrake was a sign of first-class farm land." (John Bakeless, "The Middle West," in The Eyes of Discovery, *1950).*

M. Homoya



from Flora of North America

A line drawing and field photo from Posey County depicts the habit of giant cane. Under ideal conditions this species can grow to 30 feet tall.

It may come as a surprise that bamboo is native to Indiana. Aside from using one for a fishing pole, many of us identify it as a tropical plant, one often identified with faraway jungles. But there is indeed a Hoosier version.

Our species of bamboo is commonly known as giant cane (*Arundinaria gigantea*). Occurring in colonies interconnected by tough, underground rhizomes, cane is Indiana's only native woody grass. There was a time when bottomland forests in southern Indiana were thick with large, dense growths of cane known as canebrakes. Using notes from the Public Land Survey conducted in Indiana during the late-1700s to mid-1800s I was able to map thousands of acres of canebrake occurring in bottomlands along the Ohio River. Today all canebrakes of any substantial size are gone from the state, mostly due to the clearing of the vegetation for agriculture.

In 1818 John James Audubon, the famous ornithologist and painter, described a canebrake in what is present-day Vanderburgh County. Perhaps with a bit of exaggeration he wrote: "If you picture to yourself one of these canebrakes ... you may conceive how difficult it is for one to make his way through it...". And "... the usual mode of passing through them is by pushing one's self backward, and wedging a way between the stems." That particular canebrake, intermixed with bottomland forest and bald cypress swamps, was over 8000 acres in size (see map on page 2). Today none of the natural ecosystem exists, having been scraped clean for row crops.

Audubon stated that the cane attained heights of 12 to 30 feet, with a diameter of from one to two inches. Today our cane is much smaller, with heights up to 10 feet but usually shorter and a diameter of one inch or less being more the norm. The reason for the difference in size is not clearly known

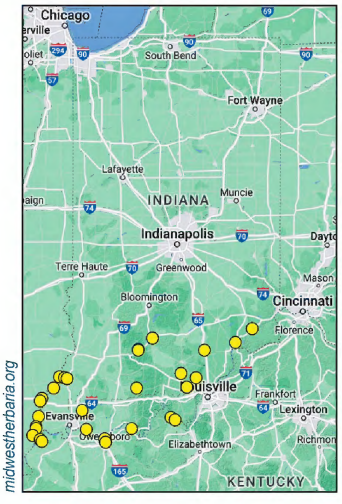
Cane — continued on page 2

Inside

Cane — *continued from front page*

This old map of Union Township south of Evansville agrees with Audubon's 1818 description that an extensive canebrake once thrived here.

Courtesy M. Homoya



midwestherbaria.org

In Indiana, most populations of giant cane occur along the lower Wabash and Ohio Rivers; but populations also occur in Lawrence and Washington counties.

but may reflect its absence from prime bottomland habitat, leaving the cane to grow in less than optimal sites. It is quite adaptable, however, and has even been found growing on the tops of high bluffs. The cane there, however, may be only 2-3 feet tall.

Like all grasses it produces rudimentary flowers, but for cane, producing flowers is a rarity, and when it does the consequences can be fatal. Cane will commonly die after heavy flowering and can cause the loss of the entire clonal population[1]. Fortunately, it generally takes decades before a given population will bloom, and the seed produced may result in the replacement of the former colony.

To observe naturally growing cane in Indiana my best advice is to look along lowland forest edges in counties that border the Ohio River, especially in the southwestern portion of the state near Evansville. Another region to search is downriver from Louisville. Giant cane has greenish-brown or tan stems with clusters of leaves at each node. Be careful not to confuse it with common reed (*Phragmites australis*), another tall grass found in Indiana. Common reed has a plume of seeds atop its stem, whereas cane does not.

Giant cane can be grown in home landscaping, but the plants don't handle below zero temperatures favorably. It's probably best to attempt it in the southern quarter of the state. Also remember that it is rhizomatous and thus can spread widely. (Hints on growing cane may be found at *https://obamawhitehouse.archives.gov/sites/default/files/omb/assets/oira_2060/2060_09262012-1.pdf*).

Efforts, especially by the Nature Conservancy, are underway to restore sites with giant cane and recreate canebrakes. It's a slow process. A two-acre site in Posey County initiated in 2007 has had recent success. Monitoring has shown giant cane well established and expanding out from initial plantings. In 2023, The Nature Conservancy began restoration at another historical canebrake in Harrison County. The project is attempting to convert old agricultural land to canebrake. With the aid of regional experts, the initial results are encouraging. Hopefully lessons learned from these two sites will someday allow this unusual grassland ecosystem to again exist broadly in southern Indiana. In the meantime, I encourage you to enjoy a musical impression entitled "Dances in the Canebrakes" by the African-American composer Florence Price (*https://youtu.be/1glvym6kSBk?si=d7nfpZ0YpemHinOC*).

[1] Botanists call this behavior "monocarpic." Monocarpic plants also include annuals (that reproduce in one year) and biennials (that reproduce in two to several years). In essence, flowering changes the hormonal balance of these plants, causing the massive redirection of resources from the roots and leaves to the production of fruits and seeds.

Michael Homoya, our Indiana State Botanist from 1982 to 2019, is a past-president of INPS and a member of the Central Chapter. The original version of this article appeared in a 2002 issue of Outdoor Indiana *magazine.*

Addendum

In the spring issue of INPS Journal, the review of May Theilgaard Watts' classic, "Reading the Landscape," seemed to indicate that the book was unavailable at the Indiana and Purdue University libraries. Both, however, do have books available for loan. Likely you could borrow them through an interlibrary loan. Our thanks to Jen Simms, IU Librarian, for bringing this to our attention!

The Wild West Comes to Florathon

By Greg Shaner

In 2022 members from the West Central chapter of INPS organized a Florathon team for the first time. Members of the Wild West team included Patty Jones, Mickey Penrod, Greg Shaner, Susan Ulrich, and Mary Sue Waser.

Thanks to our retirement status, we chose to conduct our foray on a Wednesday (May 4), replete with lovely weather. We met at Clegg Botanical Garden, a NICHES land trust property east of Lafayette on the bluffs above Wildcat Creek. This 26-acre wooded park contains many spring ephemerals. Trails pass through a beech-maple forest, an oak-hickory savanna, and along the creek. Here we made an excellent start with 37 species of native forbs in bloom representing 24 families. We encountered many of "the usual suspects," but also some less common species, such as Parlin's pussytoes (*Antennaria parlinii*) and orange-fruited horse gentian (*Triosteum aurantiacum*), both on a sunny site in the oak savanna overlooking Wildcat Creek. We also recorded two members of the carrot family: hairy-jointed meadow parsnip (*Thaspium barbinode*) and yellow pimpernel (*Taenedia integerrima*). These grew beside a trail that runs along the bank of the creek.

From Clegg we went to Mary Sue's house, not far from the Wabash River, where we found an additional four species and then ate our sack lunches. Her house was not far from Prophetstown State Park, our next stop. There, along Trail 2, which is in a densely wooded bottomland, we spotted four more species, including cut-leaf toothwort (*Cardamine concatenata*), which had been past flowering at Clegg, wild hyacinth (*Camassia scilloides*), white dog-toothed violet (*Erythronium albidum*), and prairie trillium (*Trillium recurvatum*).

Our next stop was Happy Hollow Park in West Lafayette. This site netted only one species that we had not encountered previously, but a beautiful one, drooping trillium (*Trillium flexipes*).

Our final stop was Susan's property in Warren County. It proved to be a rich site, with an additional 12 species in bloom including goldenseal (*Hydrastis canadensis*). These represented nine plant families and included the helleborine orchid (*Epipactis helleborine*), which we later learned was non-native, and one buttercup (*Ranunculus*) that we were not able to identify down to the species level. Nonetheless, we were amazed that our total for the one-day event exceeded 50 species.

Mary Sue chauffeured us for most of our foray in her Tesla and at Susan's place, a considerable distance from Lafayette, her key card slipped out of her jeans (her "useless girl front pocket" as Mary Sue expressed it). Amazingly, to us anyway, her husband was able to unlock the car and start the engine with his iPhone from 30 miles away back in Lafayette! A "wow" for modern technology.

The 2023 season seemed to get away from us, the Wild West team, but we have vowed to get together for the 2024 Florathon. We encourage you not to miss the fun and camaraderie of having your own team. Here's wishing you "Happy Botanizing!"

Greg Shaner is a member of the West Central Chapter of INPS and also leads the annual Photo Contest.

Greg Shaner

The stamens provide the showiness to the goldenseal flowers. Caution: the species has declined in Indiana due to over collecting rhizomes for herbal medicine, so enjoy this species responsibly.

*We suspect that is Mary Sue underneath the hat examining the wild geranium (*Geranium maculatum*). Certainly a hat or sunblock is an excellent precaution when spending a day in the field.*

Reminder

INPS produces informative YouTube videos on a range of native plant, home landscape care, and conservation topics. A recent selection entitled "A Truly Green Lawn," featuring Justin Curley from Purdue Extension, is definitely worth viewing (*https://youtu.be/41WVSNc0zhg?si=08floiZQLKcycmFW*). The series also has a presentation about pesticides in your garden presented by Ellen Jacquart.

Fragile Beauty:

By Ruth Ann Ingraham

All photos by R.A. Ingraham

The first instar, after creating a curved slit, lays down a net of silk threads on either side of the leaf midrib to create a protective tent over the larva.

At the third instar stage, the spicebush swallowtail caterpillar no longer mimics bird-droppings, but has faux eyes that give it a scary, snake-like appearance.

The larva's color changes from green to yellow when it is ready to pupate.

As a founding member of the Indiana Native Plant Society, I have learned over the organization's 31-year history about vital connections between native plants and the creatures they support. With that in mind, I added male and female spicebush shrubs (*Lindera benzoin*) to my garden in 1997. They provide nutritious red berries for birds in the summer and fall. I was unaware then of the shrub's additional role as a butterfly host plant; but because of my spicebushes, I experienced in a profound way another vital connection between native plants and animals.

Where does it all begin? With the egg, naturally. It is fairly typical for butterfly species to lay eggs on a limited group of host plants. These specialists fly above and around a host plant, sensing its chemistry in the air or perhaps using olfactory organs located on her feet to help locate larval food on which to lay eggs. The spicebush swallowtail (*Papilio troilus*) deposits her eggs on the foliage of only two native plant species in Indiana, spicebush (*Lindera benzoin*) and sassafras (*Sassafras albidum*), both members of the Laurel family (Lauraceae).

My journey with a spicebush swallowtail butterfly, which I would name Cate, occurred in the summer of 2022. Mid-afternoon of July 16th was warm and sunny. A dark butterfly swiftly flitted across my yard and disappeared from view. Then she reappeared on a spicebush near the busy street corner of my urban, Broad Ripple neighborhood and deposited a nearly invisible, pale-green, spherical egg on the underside of a leaf slightly above my eye level. To monitor the egg, I marked the small branch with a red twist tie. My intimate involvement in Cate's journey to adulthood – egg, larva, and pupa – began. A week later, on July 23rd, the eighth of an inch long caterpillar hatched. For quick nourishment it had eaten the contents of the egg and the shell. I worried about the larva's precarious situation, leaning over the sidewalk, so I snipped a foot-long portion of the branch with its freshly emergent life and carried it into my kitchen.

Cate, a golden-brown larva with numerous, rounded spikes, began what is dubbed "an amazing feat of natural engineering." This marvel begins with eating and growing. Wasting no time, she created a curved slit from her leaf's central vein to its edge. Then she deposited a veil of silk threads on both sides of the vein between the slit and the tip of the leaf. As the silk dried it shrank; as it shrank, the edge of the leaf arched over. Voila! Cate had a green tent that, in nature, would shield her from predators. (I chuckled when she ate a portion of her second, leafy shelter and left herself partially exposed.)

The appearance of a spicebush swallowtail's second larval form, or instar, is glossy, dark brown with a few white markings and is described as bird-dropping mimicry. Cate's next three instars were bright green with enormous, protruding faux eyes which gave her a scary, snake-like appearance to deter predators.

Mid-way through the month-long larval phase I transferred Cate to fresh foliage. She sensed a possible threat and, from her head everted a yellowish-orange, horn-like defensive organ, an osmeterium. With this she could emit a stinky toxin, known to be an effective ant deterrent.

Vladimir Nabakov, famous novelist and lepidopterist, captured how Cate may have felt as she approached the end of life as a caterpillar. "The larva feels growing discomfort, that 'tight feeling' around the neck; they're ready for the final stage, metamorphosis." Cate's skin color changed from green to bright yellow in two to three hours one afternoon (August 11th). I knew, based upon my readings, that this was the sign that transformation had begun.

In nature Cate would have then crawled to a twig in the underbrush. My kitchen solution? Twigs inserted into a pin holder used for flower arrangements and covered with thick leaf litter. Soon, while I was unthinkingly busy elsewhere in the house, she made her final move and I found her gripping the slightly arched twig.

In the pupal phase, many butterfly species hang upside down from a single point. Not so for Cate and others like her. Over the next hours, she secreted silk from salivary glands and then, muted-yellow above and apricot-toned below, she fully released her grip. One strand attached the tip of her tail to the twig;

Nature's Silent Wonders

the other strand loosely embraced her upper body. Free to let go, in the darkness of night, she wriggled out of her skin and revealed a soft and skin-like chrysalis that gradually hardened to form a protective shell. In less than 24 hours since transformation began, Cate resembled nothing more than a dried leaf.

During metamorphosis, there is movement but at a cellular level. As a pupa, what had been a caterpillar is digested from the inside out, using the same sort of juices that it used to digest food in its earlier life. Three or four days later, the chrysalis is a little bag filled with protein-rich "soup" which contains the ingredients for antennae, legs, eyes, genitals, and all the other features of an adult butterfly – such as the wings.

A butterfly's wings are its most obvious adult feature. I cannot fathom how, within the chrysalis's soup, wing colors and ornate patterns are created by a preordained alignment of millions of shingle-like, overlapping scales, each with a stalk that fits into a socket.

Toward the end of August, I was away for two nights. I left the chrysalis, still attached by the silken sling to the twig, inside a soft, net-like cage should she emerge in my absence, which she did. She was eager to fly, so I hastily unzipped the protective enclosure, snapped a photo, and watched Cate begin her ethereal flight, a fragile beauty in my garden.

Lecturing Cornell students in the 1950s, Nabokov described a butterfly's emergence in his own inimitable way. "The pupa splits as the caterpillar had split – it is really a last glorified molt, and the butterfly creeps out – and in its turn hangs down from the twig to dry. She is not handsome at first. She is very damp and bedraggled. But those limp implements of hers that she has disengaged, gradually dry, distend, the veins branch and harden – and in twenty minutes or so she is ready to fly. . . You will ask – what is the feeling of hatching? Oh, no doubt, there is a rush of panic to the head, a thrill of breathless and strange sensation, but then the eyes see, in a flow of sunshine, the butterfly sees the world, the large and awful face of the gaping entomologist."

Pondering butterflies in a broad and historic context, BBC offers a Matthew Wilson article titled *Butterflies: The Ultimate Icon of Our Fragility*. "If the climate crisis is searching for a symbol, one option is the butterfly, an insect that is not only hypersensitive to the ecosystem, but steeped with meaning in the history of art…They are living symbols of the precariousness of nature & beauty." Continuing, "It is possible to think of them as icons of hope and the ability to adapt ephemerality… Since the 4th Century BC, visual artists have been fascinated by the ephemerality of butterflies – their brief summertime appearances, their dainty structures and skittish, lackadaisical flight paths. Their most entrancing capability is to metamorphose from caterpillars… A reminder that we still have the potential to change and survive."

Our icons of fragility, butterflies are delicate and vulnerable. We know there are threats to their survival and they are increasingly dependent upon human behavior. Butterflies are among the most at risk insects. How often do we or others ask, "Where are all the butterflies this summer?" To answer the question of apparent numbers in decline one may cite multiple factors: conversion of wetlands to buildings and pavement; invasive plant and animal species that destroy crucial butterfly habitats; carelessly managed pesticides and their overuse by lawn care companies; climate change and the mis-synching of natural events.

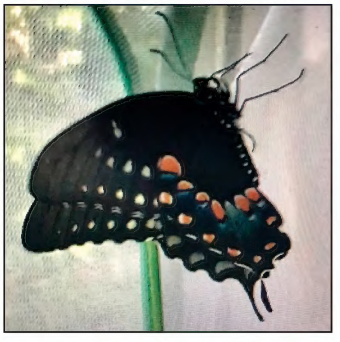
I've emphasized native species in my garden for nearly thirty years. Yet in preparing this article I realize that I could do more. I need a wider array of host plants for caterpillars and flowers to provide nectar. By example, I wish to encourage my neighbors to consider wildlife in their landscape design. And we all can donate to our favorite conservation organizations, be they the Xerces Society, The Nature Conservancy, National and Indiana Wildlife Federation, Indiana Native Plant Society, or the land trust nearest you.

Ruth Ann Ingraham, member of the Central Chapter of INPS, serves as our INPS Historian.

All photos by R.A. Ingraham

The larva lays down silk threads that attach its tail to the twig and others that form a sling around the body.

The completed pupa looks like a dried leaf.



After metamorphosis, the adult swallowtail emerges, and searches for nectar, a mate, and a suitable host plant.

Botany 101:

By Paul Rothrock

*"Pollen refers to the powdery product synthesized by seed plants responsible for the production of the male gametes of the plant" (*https://biologydictionary.net/pollen/*).*

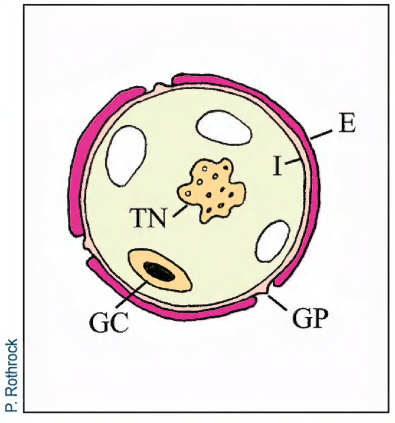
Definitions, while precise and accurate, often leave one cold. The above example tells much, but little. Certainly for plant lovers like yourself, the story begs for more, much more!

Let's tease apart our definition, beginning with the phrase "seed plants."

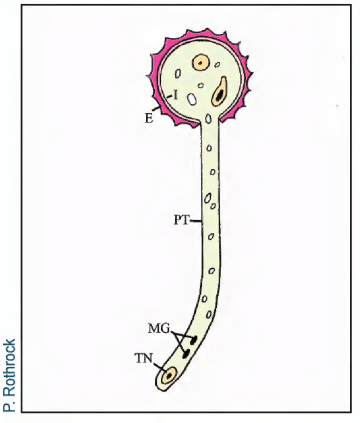
Pollen is not produced by either ferns or mosses, the most familiar non-seed plants. These plants complete their sexual life cycle by making a multitude of single-celled spores. Spores can germinate to form the next stage in the plant life cycle known as the gametophyte. And the gametophyte phase in turn is responsible for generating sperm and egg cells.

Evolutionarily, pollen and seeds are a rather recent innovation in the plant kingdom that required the coming together of multiple adaptations. These seed plant adaptations include generating two kinds of spores (abundant small ones that, after a round of cell multiplication, ultimately make sperm; large ones, that after many rounds of cell multiplication, ultimately make eggs). The adaptations also included retaining the large spores on the parent plant and coming up with means of moving the smaller ones proximal to them. Of course, after fertilization, those structures that were retained on the parent plant ultimately mature into seeds. Extinct plants known as seed ferns provide models for these seed plant innovations. Among extant plants, especially those found in Indiana, a "fern ally" known as spike-moss (genus *Selaginella*) embodies these adaptations.

"Powdery product" – When ready to be shed from a flower, pollen is composed of several cells encased in a decay-resistant and perhaps beautifully ornamented wall, the exine. The exine is so resistant to decay that pollen grains tens of thousands of years of age can be isolated from organic deposits such as those found in bogs or lake bottoms. In wind pollinated plants, the exine is smooth and dry so that the pollen can freely be blown in the wind. By contrast, in animal pollinated



This drawing of a pollen grain helps us see the difference between pollen and spores. Spores have a simpler wall that houses only one cell. The pollen grain has a decay resistant outer wall, the exine, and typically has two cells when shed from the anther. E=exine, GC=generative cell, GP=germination pore, I-intine, and TN=tube nucleus.



After pollination (i.e., after pollen lands on a receptive stigma), the pollen germinates by growing a pollen tube (PT) out through a germination pore. The tube nucleus (TN) leads the way followed by a pair of male gametes (MG) produced by the generative cell.

The Life of Pollen

plants, the exine likely is sticky and readily able to adhere to pollinators.

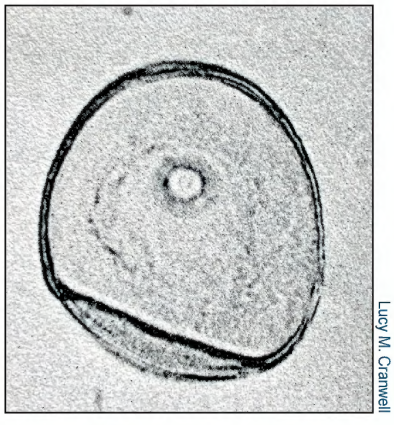
Inside the pollen grain, which technically is the male gametophyte, one finds a pair of cells in most flowering plants. One cell is a vegetative tube cell, the second a reproductive generative cell. Note that conifer pollen has many more cells, especially additional vegetative cells.

"Male gametes" – The tube cell, as its name implies, will in a germinating pollen grain expand through a pore or weak spot in the exine to form a tube. The growing tube, nourished by the flower's female pistil, winds its way toward the ovule which houses the female gametophyte and its awaiting egg cell. At this point the "genius" of the pollen tube becomes evident in that it provides a protective environment for ushering the two male gametes into the ovule. No need for these sex nuclei to navigate through the harsh outside environment. By way of contrast, in non-seed plants it is typical for sperm to be splashed and to use their microscope hairs (cilia or flagella) to swim their way to the awaiting egg cells. This entails lots more risk as well as needing an abundance of water in the environment.

When the pollen tube releases its two male gametes, both have a role in fertilization. One fuses with the egg cell and begins the process of forming a new plant. The other fuses with the polar nuclei and gives rise to endosperm. One example of endosperm deeply familiar to Hoosiers is the starch in a kernel of corn. Thus, endosperm serves as a nutritive source for a developing embryo and seedling.

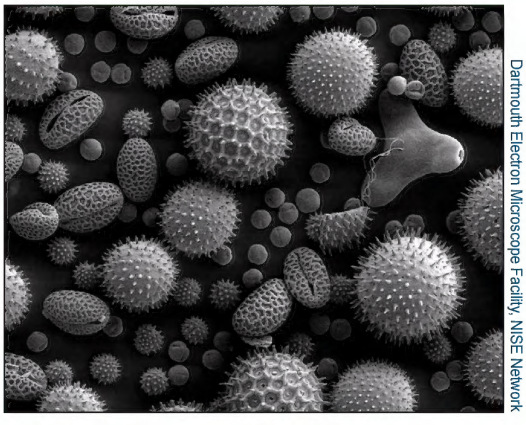
Pollen seems a deceptively simple structure and yet turns out to be a highly sophisticated product of evolution that beautifully adapts flowering plants to terrestrial environments. Pollen is one core reason that flowering plants dominate today's flora.

Paul Rothrock, a member of the South Central Chapter of INPS, taught introductory botany for about 15 years and has seen the increasing difficulty of finding college-level coursework that elucidates the secret lives of these important organisms.



Lucy M. Cranwell

Grass pollen, as seen through a light microscope, has a smooth exine characteristic of wind pollinated plants and a marked contrast with pollen carried by animal pollinators.



Dartmouth Electron Microscope Facility, NISE Network

This scanning electron microscope image captures some of the distinctive shapes of pollen grains from different species of flowering plants.

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Mission

To promote the appreciation, preservation, scientific study, and use of plants native to Indiana.

To teach people about their beauty, diversity, and importance to our environment.

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Submissions: Anyone may submit articles, photos and news items. Acceptance is at the discretion of the editors. Submit text and photos (300 ppi) via email to *journal@indiananativeplants.org*. Query for writer's guidelines. Deadlines: Jan. 1 issue – Oct 22; April 1 issue – Jan. 22; July 1 issue – April 22; Oct. 1 issue – July 22.

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Share online: Send information for posting to *webmaster@indiananativeplants.org*.

Pesticide Use in Garden Settings

By Ellen Jacquart

Every gardener has had pests in the garden and has gotten frustrated over the damage they can cause. Before taking action (aka 'going on a killing spree'), it's important to consider some basic information.

Pests are defined as any organism harmful to humans or human concerns, but what is harmful or beneficial is in the eye of the beholder. Are dandelions a pest? Or cicadas? How about cabbage worms, or milkweed tussock moth larvae? Some gardeners would call them all pests, some wouldn't. It takes careful observation and evaluation to sort out which pests really threaten your garden plants, and which are simply additional biodiversity.

In fact, observation and evaluation are the first steps of Integrated Pest Management (IPM), which addresses how to deal with pests in a step-by-step method. The very last step in IPM is to consider the use of pesticides. For those not familiar with IPM and its approach to pesticide use in the garden, I recommend the free download, *What Gardeners Should Know About Pesticides* (PPP-109) (Whitford et al. 2015).

If you go through the IPM steps and end up at the last step – pesticides – here are some things you should know.

Pesticides are chemicals used to control anything humans consider pests and are commonly used in agricultural applications as well as in home landscaping. It's important to recognize that 'pesticide' is an umbrella term for all chemicals that kill pests and that they can be broken down into more specific categories such as herbicides, insecticides, fungicides, rodenticides, and so on. Even within one category, such as insecticides, there are many different chemicals used with greatly differing impacts.

Persistence, Toxicity, and Mobility

Three useful measures to judge the risk of a particular pesticide are persistence, toxicity, and mobility. Persistence is how long a pesticide will linger in the environment, often measured in half-life. That is, how long it will take for one-half of a particular pesticide to degrade away. Toxicity is the amount of the pesticide needed to kill an organism. It is often measured by the quantity of the pesticide that it takes to kill one-half of a population of a particular organism, generally referred to as LD50. The lower the LD50, the more toxic the substance. Mobility is how far from the site of application a pesticide can be expected to move. One measure of mobility is the soil adsorption coefficient (Koc), essentially how tightly the chemical is held in the soil. If Koc is low, the pesticide has not tightly adsorbed to the soil. Thus, the lower the Koc is, the higher the mobility. Responsible use of pesticides involves finding the least persistent, least toxic, and least mobile chemical that will accomplish the control of a particular organism. In light of these characteristics, Tables 1 (herbicides) and 2 (insecticides) can help in making pesticide decisions.

Herbicides

Matching the right herbicide to the right weed pest problem is important. For instance, if Canada thistle is the problem, using contact herbicides like horticultural vinegar (acetic acid) is not helpful. Contact herbicides are the chemical equivalent of cutting the top of a plant off; they do not affect the root system and so perennial plants simply resprout. If Johnson grass is the weed issue, using Garlon® 3a (triclopyr) will not be effective because it is a selective herbicide that won't kill grasses. Be sure to read the herbicide label carefully to determine if that chemical will be effective on your plant pest, and how to use it safely. Because glyphosate is one of the least persistent, toxic, and mobile herbicides (Table 1) it is often a first choice for those controlling unwanted plants.

A word on the homemade herbicides made popular on social media, using ingredients like salt, dishwashing soap, and vinegar. Please don't. These mixes are contact herbicides that are ineffective on perennial weeds and generally will have greater impacts on soil fauna than labeled herbicides, particularly synthetic ones which are designed to target critical pathways specific to plants to avoid impacting non-plants. For instance, glyphosate disrupts the shikimic acid pathway in plants; this pathway is not found in animals, thus limiting many of its possible impacts on non-target organisms.

P. Rothrock

*Beech blight aphid (*Grylloprociphilus imbricator*) sure sounds like a serious problem if found on beech (*Fagus *spp.) in your landscape or woodlot. Before resorting to pyrethroid insecticides or insecticidal soap, start by enjoying these little wonders of nature. Some have dubbed this insect as the boogie-woogie aphid since they will wave their fluffy abdomen at you in response to disturbance. The typical problem with beech blight aphid is that they excrete honeydew and, if enough accumulates on the branches or nearby surfaces, unsightly black sooty mold (*Scorius spongiosa*) may grow. Ultimately, there is no indication that this aphid or the mold causes any real harm (see* https://carnegiemnh.org/boogie-woogie-aphids/*).*

Pesticide — continued on page 10

Pesticide — *continued from page 9*

Table 1. Persistence, Toxicity and Mobility of Some Herbicides. Compiled from a variety of sources.

Herbicide	Brand Name Examples	Persistence - (Average Soil Half-life, days)	Toxicity - (LD50 - Birds, mg/kg) (BW - bobwhite quail, M - mallards)	Mobility - Soil Sorption (Koc, mL/g)
2,4 D	Navigate®, Class®, Weed-Pro®, Justice®	10	500 (BW) [moderate]	20 (acid/salt), 100 (ester)
Clopyralid	Reclaim®, Curtail®, Transline®	40	1,465 (M) [low]	avg 6 but ranges to 60
Glyphosate	RoundUp®, Rodeo®, Accord®	47	> 4,640 (BW/M) [low]	24,000
Imazapyr	Arsenal®	25-141	> 2,150 (BW/M) [low]	poor, Koc unk.
Sethoxydim	Poast®	5	> 2,510 (M) [low]	100
Triclopyr	Garlon®, Remedy®	30	1,698 (M) [low]	20 (salt), 780 (ester)
Atrazine	Aatrex®, Astram®,Atratol®	14-109	>2,000 (M)	<500

Weed Control Methods Handbook. The Nature Conservancy. Tu *et al.*

Insecticides

Table 2 shows the wide range of persistence, toxicity, and mobility of insecticides. On the low end of the range are permethrin and neem oil, both organic insecticides. These can be very effective and should be considered first for small scale pest applications.

On the other end of the spectrum are the neonicotinoids (neonics), insecticides developed in the 1990s that are the most persistent, most toxic, and most mobile insecticides. They are now also the most used insecticide world-wide, primarily in agriculture including their common use as a seed coating on corn. In home settings, neonics are used to treat pets for fleas and ticks, to treat ash trees for emerald ash borers, and are commonly added to ornamental perennials, shrubs, and trees by sellers to reduce insect damage.

Neonics are highly toxic. The typical application rate of neonics in seed coatings is 1.25 mg per corn kernel. That amount of neonic is enough to kill over 150,000 honeybees if applied evenly. Given that planted seeds are never fully covered with soil and that spills of seeds are common, treated seeds are easily found by foraging birds. The risk of acute intoxication with imidacloprid is high. Indeed, a single corn kernel coated with a neonic can kill a songbird (Mineau & Palmer 2013).

Neonics are highly mobile in the soil. It's estimated that 2-20% of seed dressing ends up in plant tissues, about 2% is dispersed as dust, but most ends up in the soil (El-Hamady et al. 2008). Since neonics are water soluble, they are then carried to nearby water bodies through surface runoff, tile drainage, lateral flow, or leaching. Untreated plants take up neonics from the soil wherever they end up, rendering those plants toxic to insects.

Neonics can be highly persistent with the half-life depending on soil type and conditions (see Table 2 for examples). In one study clothianidin was found to have a soil half-life of 3.8 years in North Dakota clay loam (DeCant & Barrett 2010). Given their long persistence, it has been found that neonics can accumulate in soils over time.

It's been clear for some time that neonics are having a significant impact on non-target insects, leading Leahy (2019) to observe that "This is the second Silent Spring. Neonics are like a new DDT, except they are a thousand times more toxic to bees than DDT was." Because of their high toxicity, mobility, and persistence, it is thought that the tremendous decreases in insect populations from the 1990s are due at least in part to the explosion of neonic use.

In June 2022 the USEPA released final biological evaluations confirming that three neonics – clothianidin, imidacloprid, and thiamethoxam – likely harm roughly three-fourths of all endangered plants and animals, including all 39 species of amphibians protected under the Endangered Species Act. These neonics are currently undergoing registration review at the USEPA with findings to be available in 2024.

Table 2. Persistence, Toxicity and Mobility of some Insecticides. Compiled from a variety of sources.

Insecticide	Persistence - (Average Soil Half-life, days)	Toxicity - (LD50 - Mallard, mg/kg)	Mobility - Soil Sorption (Koc, mL/g)
Carbamates:			
Carbaryl	4-253	>2,179	144-671
Neonicotinoids:			
Acetamiprid	8.2	98	260
Clothianidin	148-6,931	>752	160
Imidacloprid	26.5-229	283	262
Thiamethoxam	7-353	576	43-77
Organochlorines:			
Chlordane	150-6,900	83	4
DDT	730-5,475	2,240	
Toxaphene	35-3,000	37.6-133	
Organophosphates:			
Diazinon	21-103	3.5	4,981
Fenthion	28-1,250	1	15,000
Malathion	17	1,485	1,800
Pyrethroids:			
Cyfluthrin	34-56	>5,000	
Esfenvalerate	148-6,931	>2,250	
Permethrin	11.6-113	>9,900	10,471-86,000
Azadirachtin (Neem oil)	13-44	16,640	93

Summary

All pesticides should be used with caution after following IPM methodology. That said, the risk of a particular pesticide varies greatly based on the pesticide's persistence, toxicity, and mobility, and knowing more about the specific active ingredients in a pesticide is necessary to understand that risk. Neonicotinoids pose particular risk because of their long persistence, high toxicity, and great mobility.

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El-Hamady, S.E., E. Kubiak & A.S. Derbalah. 2008. Fate of imidacloprid in soil and plant after application to cotton seeds. Chemosphere 71:2173-2179.

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Ellen Jacquart, a member of the INPS South Central Chapter, is a past-president of INPS and led the organization of the 2023 INPS Annual Conference.

The Goldsmith Tragedy

By Charles M. Ek

Published in The Kokomo Telegraph on July 18, 1941

[Editor's note: After retiring from Pittsburgh Glass Co. in 1937, Charles Ek (1873-1960) actively studied the flora of Indiana, especially in Howard County. Many of his specimens are preserved at the Butler University, Indiana University, and New York Botanical Garden herbaria. His correspondence with fellow botanists Charles Deam and Ray Friesner may be studied at the Indiana State Library. This editorial by Ek, recently discovered in files at the Indiana University Herbarium, highlights a remnant prairie that could be found along a railroad line in the 1940s. Modern herbicide treatment has severely reduced the opportunity for finding these small pieces of Indiana's rich natural heritage. Even in Ek's day, their value was apparently under-appreciated. However, since 1967, following the establishment of the Division of Nature Preserves at the Indiana Department of Natural Resources, some of these remnants have been included in a system of over 300 nature preserves.]

P. Rothrock

*The appropriately named queen-of-the-prairie (*Filipendula rubra*) was among the forbs known historically from the Goldsmith railroad right-of-way.*

In Central Indiana, where the land is intensively cultivated and virgin forests are so rare, and most of the farms overgrazed, the best places to botanize are the railroads. In past years these grounds were mowed and sometimes burned, which never profited the railroad a cent. Even so they still afford a place for many of our native plants to persist.

I have walked all the railroads in Howard County from May to October and nearly every mile in Tipton and Miami counties and many miles in Cass, Grant, White and other northern counties.

The most classical spot in Central Indiana was the first mile along the railroad west of Goldsmith in Tipton County. The prairie region seems to begin here and this mile is rich in plants of a prairie habitat. It is a meeting place of plants of north and south. Others occur here that are found in the sand regions to the north or the hills to the south.

One going from the barren monotonous waste places elsewhere to this spot, senses a different atmosphere. At once the change is apparent on all sides. You are in a new environment with strange flowers all about you. You may know every species in Howard county [sic] and go there in May, July and September and over a dozen new plants will greet you each trip.

A few of the large conspicuous flowers recalled are Liatris, Stiff Goldenrod, white Boltonia, Smooth Aster, resin weeds [sic], compass plants, Feverfew, coneflowers, sunflowers and Spiderworts. Tall coreopsis [was present] also some grasses and sedges and less conspicuous plants [such] as milkworts and St. John's wort. Two rare roses were there.[1]

What was my consternation and chagrin last Oct. 6 [1940] when expecting another feast and a few hours of inspiration, to behold all on the south side of the railroad to the woods had been mowed by a machine. On Oct. 12 it had been burned. However the day was not lost, for a half mile further on I made a very important find, new to Indiana, a colony of Amethyst Aster, a hybrid of the beautiful New England wreath-asters.

Who did this dastardly deed? What gain was to be expected? It is difficult to conceive what logic was used or what sort of education would fit such ignorance. The energy used by prize fighters and ball players could profitably be utilized against these desecrators of beauty. The time and energy wasted here could have been spent in a thousand ways with profit. The loss to science and art is irreparable. The foremost botanists of Indiana, Doctors Deam, Friesner, Potzger and McCoy have worked this area. This was indeed Holy Ground. A list of the species found by each of us would be quite similar.

The Indiana Academy of Science is directly interested in the preservation of every species in the state but they seem to do little about such outrages. The combined strength of the "Izaac Walton League of Indiana" must lend a hand. Do this for Science and the preservation of our scattered beauty spots.

[1] A search of midwestherbaria.org provides an impressive list of collections from Goldsmith, Tipton County, Indiana. The Indiana University Herbarium has 131 taxa collected along this railroad right-of-way between 1913 and 1940. The collections include Ek's "Amethyst Aster" (= *Symphyotrichum* × *amethystinum*).

Wild Lupine Alert

Prairie Moon Nursery, a reputable native plant retailer in Minnesota, recently posted a warning of interest to us in the Midwest. It concerns our native sundial lupine (*Lupinus perennis*), the larval host for the endangered Karner's blue butterfly (as described in the INPS Journal, summer 2023, vol. 30(2)). There is taxonomic confusion in the nursery trade. The western lupine (*L. polyphyllus*) has become conflated with our regional species. Here is what Prairie Moon Nursery has to say:

"Because Western Lupine (*L. polyphyllus*) is a larger, showier plant and spreads rapidly, it has infiltrated the seed market as "Wild Lupine" and incorrectly as "Lupinus perennis." It has been proven to be very aggressive, especially in the Upper Midwest and Northeast regions. Beyond its ability to spread and overwinter, *L. polyphyllus* is upsetting the balance of local wildlife in the eastern half of the U.S. – most notably for the federally endangered Karner Blue Butterfly whose only larval host is Sundial Lupine. The Western Lupine is NOT a larval host for this beloved species, despite the marketing push; according to the National Park Service, the foliage is poisonous. Any Karner Blues that mistakenly lay their eggs on this plant have doomed their caterpillars. Sadly, *L. polyphyllus* readily hybridizes with Sundial Lupine; the resulting plants are also inhospitable."[1]

Our INPS members should become familiar with the differences between the two species. The native sundial lupine is a smaller plant. Its leaves have fewer leaflets (7-11 versus 12-18) that are shorter (only up to 2" long). Likewise the inflorescences of the native species are shorter (racemes may reach to 12" compared to mostly greater than 12" in the non-native species).

[1] *https://www.prairiemoon.com/whats-in-a-name.html*

P. Rothrock

Each palmately compound leaf of this sundial lupine has 7-8 leaflets but could have as many as 11. The leaves of western lupine have more than 11 leaflets and these are longer.

Free Publication: Indiana Dunes National Park Floristic Study

For the serious botanists among us, there is a new publication available for download. It presents detailed information about plant species and vegetation in each sector of Indiana Dunes National Park.

You can find it at *https://irma.nps.gov/DataStore/DownloadFile/699639.*

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Morton Arboretum — continued from page 16

Gentian, Rose Gentian, Bog Lobelia, Grass of Parnassus, Shrubby Cinquefoil, Stiff Aster, Purple False Foxglove, Bog Arrow Grass, Shrubby St. John's Wort, and hundreds of other species., including what may be the southernmost colony of Jack Pine in the world. With its lagoons and rolling dunes it is probably the most scenic area within the corporate limits of any large city in the entire Midwest. Its preservation is an absolute must. It is owned by the U.S. Steel Corporation."

The precious 40-acre Clark and Pine Nature Preserve is located in northwest Gary, Indiana, nestled between the Gary International Airport and the U.S. Steel facility. It preserves rare dune-and-swale habitat near Lake Michigan.

Jim Smith

[Note: This area has now been included within the boundaries of Indiana Dunes National Park.]

The area along Clark Road in the west part of Gary, north of the Gary Airport, and north of US Highway 12, is still very much intact, although crisscrossed by numerous railroads. In here are Indian Paintbrush, Yellow Lady's Slipper, Buffalo Berry (the only site in Indiana), Golden Ragwort, Prairie Phlox, Lead Plant, Purple Prairie Clover, Fragrant Sumac, Prickly-Pear Cactus, Hairy Puccoon, Hoary Puccoon, Purple Milkwort, Nodding Pogonia, Ladies' Tresses, Grass Pink, Blue Hearts, Purple Bladderwort, Yellow Bladderwort, Yellow Pond Lily, White Water Lily, Buckbean, Yellow Star Grass, Blue-Eyed Grass, Blue Flag, and hundreds of additional species. Pepoon wrote of this glowingly in his Flora of the Chicago Region in 1926 – he called it Clarke and Pine. The northern portion is owned by U.S. Steel Corporation.

[Note: This area is now protected as Clark and Pine Dune and Swale Nature Preserve. It was acquired from General Refractories thanks to the hard work of Dennis Wolkoff, Director of the Indiana Chapter of The Nature Conservancy. The large area east of Clark Road has also been protected and is known as Pine Station Nature Preserve. It was acquired by DNR as mitigation for wetlands filled by nearby industrial development.]

The Tolleston portion of southwest Gary along the E.J. & E. Railroad and the border of Hammond is excellent. It has large tracts of Black Oak Woods with its typical sand flora. Housing inroads have destroyed some areas, but there is still much worth saving.

[Note: While the specific site Swink mentioned was not protected, nearby Black Oak-dominated dune and swale areas have been protected in Gibson Woods, Tolleston Ridges, Cline Avenue, Seidner, and Ivanhoe Dune and Swale Nature Preserves, and are owned and managed by Lake County Parks, DNR Nature Preserves, Shirley Heinze Land Trust, and The Nature Conservancy, respectively.]

The Schererville-Griffith prairie is already known to you, and is a high priority area for preservation, with many prairie species.

[Note: This area is now protected as Hoosier Prairie Nature Preserve. The name "Hoosier Prairie" was suggested by Dr. Betz.]

The Cook Prairie is located south of the village of St. John in Lake County. It is on the south side of Route 8 between Route 41 and the Penn Central Railroad – east side of Route 41. It is a clay-soil prairie of very high quality (this type of prairie is very rare in northwestern Indiana). It intrigued Dr. Bliss at the University of Illinois, so much that he wrote a scientific article concerning it.

[Note: This area is now protected as Biesecker Prairie Nature Preserve. It was

Paul Rothrock

*Remarkably, the 34-acre Biesecker Prairie in Newton County may have up to 17 species in an area of less than 2 × 2 ft. It has a profusion of wild quinine (*Parthenium integrifolium*), prairie dock (*Silphium terebinthinaceum*), and prairie dropseed (*Sporobolus heterolepis*).*

protected after years of work by Dr. Betz and Bill Weeks of The Nature Conservancy.]

Mill Creek Bog. This is on an east-west road a mile or so north of Mill Creek in LaPorte County. It is a kind of hanging bog, or better, a calcareous fen. It contains one of the few localities for Downy Willow-Herb, *Epilobium strictum*, and for Death Camass, *Zigadenus glaucus*. It has many prairie wildflowers and is a high priority for preservation.

[Note: We were unsuccessful in protecting this site. Mill Creek Fen lost its natural quality over the years due to invasive species and a loss of groundwater.]

There is a bog containing Tamarack, Goldthread, and other interesting species on the north side of Koontz Lake in Starke County.

[Note: This area has been protected as Koontz Lake Nature Preserve.]

I realize this may be preserved anyway, but top priority must be given to Pinhook Bog, also known as Jackman Bog and Austin Bog. This is on Wozniak Road immediately north of the Indiana Toll Road. It contains Rose Pogonia, Orange Fringed Orchid, Grass Pink Orchid, Tall Blueberry, White Pine, Tamarack, Leatherleaf, Bog Rosemary, Narrow-leaved Sundew, Pink Lady's Slipper, Pitcher Plant, White Beak Rush, and a whole host of other things. It is Indiana's finest bog.

[Note: Pinhook Bog has been protected within the Indiana Dunes National Park.]

Along Trail Creek, especially on the east side, south of Rt. 20-35 near Michigan City in LaPorte County is an area worth preservation. There are hundreds of thousands (no exaggeration!!!) of the very rare Corn Salad, *Valerianella chenopodifolia*, turning the ground white with their bloom about May 1st. I know of no other Midwestern locality for this, but I am sure there are other records.

[Note: This area was acquired by the Indiana DNR Division of Fish and Wildlife.]

There are fine prairie areas along the Monon Railroad about one-half mile north of Haskell in LaPorte County.

[Note: This railroad prairie contained hundreds of individuals of royal catchfly (*Silene regia*). It was a rare type of prairie remnant, a dry-mesic prairie, dominated by porcupine grass (*Hesperostipa spartea*). Other rare species found there included western silver American-aster (*Symphyotrichum sericeum*), Nuttall's prairie-parsley (*Polytaenia nuttallii*), and downy gentian (*Gentiana puberulenta*). Despite attempts at acquisition once the railroad line was abandoned, the owners plowed up this prairie and planted corn.]

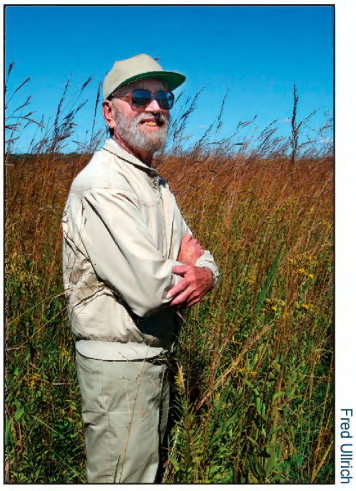
North of Enos along both sides of Route 41 is a large area of good flatland containing marsh and prairie. In addition to the botanical interest, it is a last-ditch refuge for the declining Prairie Chicken. Enos is in Newton County.

[Note: Much of this area has been protected and/or restored as Conrad Savanna and Conrad Station and Beaver Lake Prairie Nature Preserves, and Kankakee Sands wetland and prairie restoration. These efforts were too late to save the Prairie Chicken, now extirpated from Indiana.]

If you have questions on these or other areas, please do not hesitate to contact me.

Cordially yours,
Floyd A. Swink."

Following receipt of this letter, Nature Preserves staff spent a week at the Morton Arboretum with Floyd Swink, Ray Schulenburg, and Gerould Wilhelm, studying topographic maps for all seven counties within the northwest Indiana portion of the Chicago Region. Numerous days were spent in the field with Dr. Betz, visiting all the prairies he was aware of. We all owe a huge thank you to all of them and the Morton Arboretum for assistance in guiding our protection efforts. The sites that are available for us to enjoy today were protected thanks to them.



Fred Ullrich

Robert Betz (1923-2007), although trained as a microbiologist and biochemist, became fascinated with tallgrass prairies. He guided the 1200-acre restoration prairie project at Fermi Lab and helped preserve over 40 prairie remnants, including many in Indiana.

Reference

Lindsey, A.A., D.V. Schmelz & S.A. Nichols. 1969. Natural Areas in Indiana and Their Preservation. Indiana Natural Areas Survey, Department of Biological Sciences, Purdue University, Lafayette, IN.

John Bacone, a member of the Central Chapter of INPS, is the retired Director of the Division of Nature Preserves.

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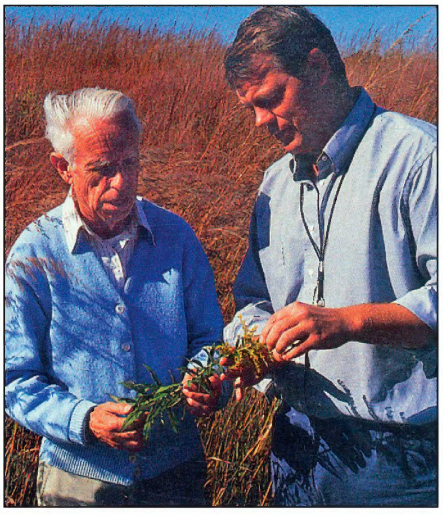
The Morton Arboretum and the Division of Nature Preserves: Long-time Conservation Partners

By John A. Bacone



courtesy Gerould Wilhelm

This 1993 photo shows Floyd Swink (1921-2001) with his protege Gerould Wilhelm. Their lifelong study of Chicago region flora included detailed knowledge of 12 northwest Indiana counties.

For over a century the Morton Arboretum has promoted the study and conservation of plants. The interest in the native and naturalized flora of the Chicago Region dates to the early 1960s when Floyd Swink was hired as plant taxonomist and Ray Schulenberg was charged with launching an early effort at prairie restoration on the west side of the property. As Swink's efforts to document the flora of the Chicago region took shape, he published a first list of species in his 1969 *Plants of the Chicago Region*. The Chicago flora as envisioned by Swink included seven counties in northwest Indiana as well as counties of Michigan and Wisconsin within a reasonable day trip from the city. This initial publication launched a multi-decades long effort to document the region's flora. Other esteemed botanists joined Swink's effort, including Gerould Wilhelm (who initially joined the Arboretum staff in 1976) and Robert Betz, biologist from Northeastern Illinois University with a particular interest in native prairie ecosystems. As a result, Chicago region botanists gathered considerable information about many of Indiana's highest quality natural areas.

When the Division of Nature Preserves was established by the Indiana Legislature in 1967, Bill Barnes was appointed to be the Division's first director. In October 1969, Floyd Swink wrote Barnes a letter regarding natural areas in northwest Indiana. This letter described a number of high-quality natural areas. Barnes used this list as well as the natural areas included in *Natural Areas in Indiana and Their Preservation* (Lindsey et al. 1969) to prioritize natural areas that needed protection.

It is exciting to read this letter, published below with annotations as to their current status, since many of these areas were pursued and protected. At the same time it is sobering to see several of the "misses" that were lost.

"Dear Mr. Barnes:

Dr. Robert Betz has asked me to send you information on natural areas in northwestern Indiana.

One prime area is in Miller (part of Gary) in Lake County. The area lies north of the Grand Calumet River extending to Lake Michigan, with the U.S. Steel Corporations slag piles on the west and Lake Street on the east. This large area has Fringed

Morton Arboretum — *continued on page 15*